FY'2012 STATE WILDLIFE GRANT (SWG)

State of Illinois
Grant Narrative

Project Title: Ecology of the Smooth Softshell in the Kaskaskia River: Implications for Managing Flows in an Altered System

Project Number: T-87-D-1

Submitted by:

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NEED

Illinois' Comprehensive Wildlife Conservation Plan and Strategy (IWAP) outlines landscape, ecosystem, habitat, and population actions to promote conserving Illinois' biological heritage (IDNR, 2005). A critical information gap identified within the IWAP's Stream Campaign is identifying and addressing limiting factors for indicator species or organismal communities (IDNR, 2005). The IWAP identifies a suite of limiting factors that include altered natural disturbance regimes, sedimentation and sediment loads, habitat reduction and fragmentation, and invasive species (IDNR, 2005). This information will help agencies, organizations and citizens to develop responsible plans for water use and management by balancing ecological impacts of altered flows with human benefits of these actions (e.g., flood control, municipal supplies). IWAP identifies the Smooth Softshell (*Apalone mutica*) as a nongame indicator species (IDNR, 2005, p. 207), a critical species (IDNR, 2005, pp. 216 & 225), and a species in greatest need of conservation (IDNR, 2005, p. 306). It is an excellent subject to study altered flows because it uses both aquatic and terrestrial habitats affected by flow regimes. Additionally, the stressors for the Smooth Softshell identified in the IWAP reflect a lack of ecological information. Classification of all stressors suggest the threats have little to moderate effects on population viability or abundance, but the confidence of these classifications are very low confidence to no available information (IDNR, 2005, p. 325). Clearly, we need information on the Smooth Softshell's general

ecology, as well as, the threats associated with modified hydrological regimes in medium to large rivers it occupies.

OBJECTIVES

Given the ecological sensitivity and the data gap for interpreting the effects of stressors, we propose to focus on habitat and population stresses on the Smooth Softshell in the Kaskaskia River. Our objectives fill six categories with the first four assessing needs, status, and risks. The final objective will develop conservation actions directed at easing the issues and risks detected during the study.

1. **Habitat and Spatial Needs** – Identify critical habitats for the Smooth Softshell by affixing radio transmitters to 40 individuals and determining locations of turtles >700 times during a 2-year study on the Kaskaskia River.

2. **Community and Population Structure** – Check capture devices (e.g., hoop, fyke, and basking traps) on >40 occasions (i.e., >400 trap-nights) during a 2-year study to describe traits of the turtle community (all species inhabiting the study area) and population structure of Smooth Softshell turtles. Metrics used to describe the turtle community will include species richness, relative abundances, and species diversity of individuals encountered in capture devices; metrics used to describe population structure of Smooth Softshell turtles will include abundance or relative abundance, sex ratios, age ratios, nest success, and survival rates of individuals marked uniquely or affixed with radio transmitters.

3. **Behavioral Responses** – Identify behavioral responses to manipulation of water levels of the Kaskaskia River by affixing radio transmitters to 40 individuals and determining locations of turtles >700 times during a 2-year study to identify relationships between behavior (e.g., movement rates, space use, habitat use) and environmental conditions (e.g., rates of water flow, water depths). Note that our ability to quantify behavior of Smooth Softshell turtles will rely on observational rather than manipulative experimental approaches because of our inability to control environmental conditions (i.e., precipitation) and anthropogenic factors (i.e., when and how much water is released from Shelbyville and Carlyle lakes by the Army Corps of Engineers).

4. **Phenological Risks** – Assess risks of water level manipulations during the nesting and over-wintering seasons by monitoring >10 nesting attempts by females, fates of >10 nests, and responses of >20 individuals while over-wintering. Note that our ability to relate nest success and behavioral responses to manipulations of water levels will rely on observational rather than manipulative experimental approaches because of our inability to control environmental conditions (i.e., precipitation) and anthropogenic factors (i.e., when and how much water is released from Shelbyville and Carlyle lakes by the Army Corps of Engineers).

5. **Management Responses** – For each objective, we will recommend conservation actions that preserve or improve habitats used by the Smooth Softshell.

APPROACH

DATA SOURCES.– We will use a combined approach of mark/recapture and radio-tracking to achieve our objectives. We will select two reaches of the Kaskaskia River, one between the Shelbyville and Carlyle dams, and one below the Carlyle dam. For stream flow rates and other river related parameters, we will

use the stream flow data collected from the following USGS gauging stations along the Kaskaskia River, sites 05592000 (at Shelbyville), 05592100 (at Cowden), 05592500 (at Vandalia), 05593000 (at Carlyle), 05594100 (near Vendy Station), 0559500 (at New Athens), and 05595240 (near Red Bud). Although we will be recording proximate weather variables at each location, we will also use larger-scale climatic variables collected from NWS weather stations nearest to the study sites.

We will conduct trapping along the reaches of the river using baited hoop traps, fyke nets, dip nets, seines, and basking traps. We will conduct trapping in one three-day bout during March, April, August, and September and two weekly bouts for May, June, and July. All captured turtles will be given a unique (within species) shell notch. Turtles will be classified into one of three stage/sex categories; males, females, and juveniles. Males will be identified by having the combination of elongated fore-claws and cloacal vent extension well beyond the posterior carapace margin. Females will be identified by having relatively short fore-claws and a cloacal vent that did not extend beyond the posterior carapace margin. All small and ambiguous individuals will be classified as juveniles. We will take the following morphological measurements to the nearest mm using metric tree calipers: carapace length (CL), carapace width (CW), plastron length (PL), and shell height (SH). We will weigh turtles using OHAUS electronic scales to the nearest gram. We will take blood samples from the cervical sinus of turtles for future DNA analysis. We will take no more than 0.1 cc per 100 grams of turtle mass and then store all samples in a -80°C freezer at the INHS. In addition, we will affix small temperature data loggers to a subset of all softshells captured in order to determine the environmental temperature regime the turtles use throughout the year. Next, we will x-radiograph a subset of adult female Smooth Softshells to determine reproductive condition and clutch size closer to the nesting season. In addition, we may also use some limited radio-telemetry of these individuals to bolster sample sizes for nesting.

We will radio-equip 40 Smooth Softshells, 20 turtles at a site above and below the Carlyle reservoir, representing and even sex ratio with two-year radio-transmitters. We will radio-track turtles at least three times a week during the active season and twice a month during the inactive season. Tracking intensity will increase to at least daily during the nesting season to identify nesting habitat and mark nest locations. At each visual location, we will record behavior as well as a suite of habitat and local climate such as air temperature, water temperature, relative humidity, water depth, canopy cover, vegetation height, presence of absence of aquatic vegetation, and habitat type.

DATA ANALYSIS.– We will calculate the relative abundance as the proportion a turtle species was given the entire sample of turtles. Using the relative abundance, we will calculate the Shannon diversity index and eveness for the turtle community. We will construct rarefaction curves and rank abundance curves to compare species richness among trapping sites. We will partition all turtles into 10 mm size classes by sex/stage for graphical representation. We will calculate the overall sex ratio using the number of sexable males and females, the adult sex ratios, and the juvenile to adult ratio for each species with sufficient representation. We will determine if ratios deviate from equality using χ^2 tests. Finally, if we capture and recapture enough turtles, we will estimate population size using the most appropriate closed or open models.

For radio-telemetry data, we will plot all coordinates on aerial photographs in ArcGIS then calculate and create movement paths and home ranges for individuals. Movement parameters include mean, minimum, and maximum daily distance moved and total distance moved for each individual. We will then estimate home range areas using the minimum convex polygon (MCP) and 95%, 75%, and 50% kernel density isopleths (KDI) methods. We will test for differences in movement and home range estimates between sexes, seasons, and with the stream flow data collected from the USGS gauging stations. In addition, we will use our behavioral variables to examine seasonal differences and

differences associated with different hydrological regimes (i.e. flooding or drought). We will calculate the habitat use by calculating mean proportional use or using compositional analysis then test for seasonal, sex, or environmental related effects.

RELATIONSHIPS TO THE IWAP

The IWAP cites the Smooth Softshell five times, most notably as a critical species (pp. 216 & 225). Our project meets several goals of the Stream Campaign (pp. 60–65), conservation of biota per Natural Division, and filling in information gaps for species in greatest need of conservation. Specifically within the Streams Campaign, this project fills the roles of action 7. "*Fill information gaps and develop conservation actions to address stresses*"(p. 64). Under action 7 this project fills the role for 7b and 7d. (p. 64). This project will fit in the goals for conservation within most of natural divisions of Illinois due to the Smooth Softshell's occurrence in inland rivers crossing divisional boundaries. Finally, the goals and products of this project will create actions promoting habitat conservation and population viability through a direct assessment of the stressors.

RELATIONSHIPS TO 522 FW 12 – SURVEYS AND INVENTORIES

The sample size of 40 turtles tracked multiple times weekly over two years, the census designs, the point data collection and statistical analyses (*see* Methods) are robust compared to other spatial ecological studies on turtles (*see* Ernst and Ernst, 2009). The radio telemetric data and analysis also utilize well established procedures and methods (Manly *et al.*, 2002; Kenward, 2001; Millspaugh and Marzluff, 2001; White and Garrott, 1990). The population specific data collection methods follow the appropriate standards outlined for amphibians and reptiles (*see* McDiarmid *et al.*, 2012; Heyer *et al.*, 1994). Finally, the statistical analyses and procedures that will be conducted are reliable measures (*see* Sutherland, 1997; Zar 1996; Sokal and Rolf, 1995; Brower *et al.*, 1990; Krebs, 1989). Data will be collected in the most cost effective method possible using a staggered 3-day/week sampling technique for radiotelemetry that minimizes the potential for diminishing returns in data necessity. For population level surveys, the one-week trapping bout technique is the most efficient as it allows a greater area to be covered with strong intensity. Finally, the study design itself is constructed so only one pair of researchers is necessary. Thus, the techniques and design used for data collection represent the most cost efficient method in terms of dollars and staff time.

ANTICIPATED OUTCOMES AND BENEFITS

Overall, our findings will help agencies and organizations to define system-wide objectives for water use and management in the Kaskaskia River Basin. Specifically by objectives the anticipated benefits and outcomes are:

Habitat and Spatial Needs – Results will provide a firmer understanding of the habitat stresses of extent, fragmentation, composition-structure, disturbance/hydrology.

1. **Extent** – Provide estimates of area use during the active season and how much movement occurs within the area of use.
2. **Fragmentation** – Provide a determination if riverine barriers exist to movement, i.e. dams, riffles, highway/road crossings.
3. **Composition-Structure** – Provide estimates of macro- and microhabitat use and create a habitat suitability model for the river system to assess the amount and quality of habitat.

4. **Disturbance/Hydrology** – Provide a determination if a shift in spatial requirements or habitat use occurs with disturbance events such as periodic flooding caused by management of water levels at Shelbyville and Carlyle reservoirs.

Community/Population Structure – Results will determine Smooth Softshell abundance within the turtle assemblage, possibly provide estimates of population size, adult sex ratios, and proportion of adults in the population.

1. **Competitors** – Provide a determination of where Smooth Softshell place in the turtle community.
2. **Recruitment** – Provide estimates of population, structure, and sex ratios for use in estimating how many reproductive females are present in the population to propel population growth rates.
3. **Mortality** – Provide estimates of mortality using radio-telemetry and mark/recapture techniques. Radio-telemetry will afford annual mortality estimates and careful classification of mortality events will allow a ranking of most to least severe mortality threats.

Behavioral Responses – Results will determine how Smooth Softshells behaviorally cope with manipulation of water levels of the Kaskaskia River using both a combined spatial ecological and behavioral approach.

1. **Activity Levels** – Provide a determination if Smooth Softshells reduce their activity, movements and home range size, during periods of high water or flow rates from USGS gauging stations.
2. **Behavioral Shifts** – Provide a determination if turtles show shifts in behavior during periods of high/low water levels or high/low flow rates.
3. **Thermal Challenges** – Provide a determination of how turtles cope with thermal challenges (i.e. basking site reduction or drought conditions) during periods of high/low water levels or high/low flow rates.

Phenological Risks – Our results will assess the risks of water level manipulations during critical points in the phenology of the Smooth Softshell (nesting and over-wintering).

1. **Nesting** – Provide a determination how high/low water levels or high/low flow rates affect nest sites and or nesting behavior. In addition, this study will provide nest mortality estimates that could encompass flooding or drought conditions.
2. **Over-wintering** – Provide estimates of over-wintering mortality related to flow rates and water levels during the winter. Although large difference in two-seasons may not occur, we will able to provide a general assessment if effects are present and a framework to further detail any effects.

Management Responses – The overall result of our study is if and how water level manipulation in the Kaskaskia River affects several ecological and life history characteristics of the Smooth Softshell (an indicator species). We will then create a series of specific recommendations and conservation actions that balance the need for water control with the needs of the Smooth Softshell and other ecologically similar riverine species.

GEOGRAPHIC LOCATION

The project will occur in the Kaskaskia River in south-central Illinois from south of Lake Shelbyville to south of Carlyle Lake (Plates 1). The Kaskaskia River flows approximately 325 miles from its origin in western Champaign County to its confluence with the Mississippi River near Chester, Illinois. Along the Kaskaskia River, the United States Army Corps of Engineers has constructed two impoundments to control flooding and provide source water for Mississippi River navigation. Lake Shelbyville, the

northern impoundment, has a normal surface pool of 11,100 acres with 23,000 acres of surrounding public lands. Construction of Lake Shelbyville began in August of 1970 and lake dedication was finalized in September 1970. Carlyle Lake, the southern impoundment, is the largest manmade reservoir in Illinois (26,000 acres) with 11,000 acres of public lands. Construction of Carlyle Lake began in October 1958 and lake dedication was finalized in June 1967. This project will not occur in either impoundment, but rather within the river channel at one site below Lake Shelbyville and one site below Carlyle Lake (Plate 1; Yellow Line). The counties the project will occur in include Bond, Clinton, Fayette, Shelby, St. Clair, and Washington (Plate 1; Gray). Within each county, the study sites will be selected based on reconnaissance trapping for Smooth Softshells and the amount of suitable habitat present.

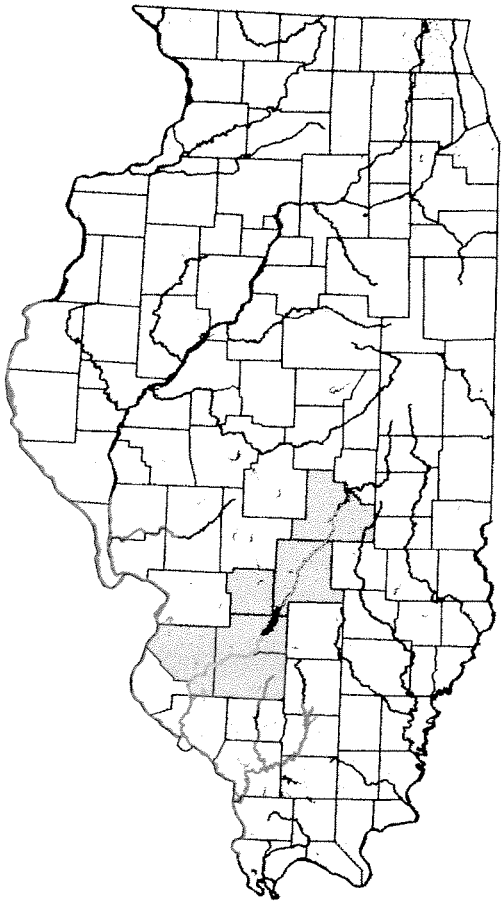

PLATE 1: County and river level map of project area within Illinois. The counties where the project will occur are shaded gray, the rivers and lakes are blue, and the project area is outlined in yellow.

PERSONNEL

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USEFUL LIFE

This project is not a capital improvement project of greater than $100,000 so this section does not apply.

MULTIPURPOSE PROJECTS

This project does not qualify as a multipurpose project therefore this section is not applicable.

RELATIONSHIPS WITH OTHER GRANTS

This project has no relationship with any anticipated or underway projects. The results from this project may be used for planning a larger multi-year conservation and management projects.

PROGRAM INCOME

This grant will generate no additional income therefore this section does not apply.

GENERAL

This project states a need consistent with the Endangered Species Act and the IWAP, in that, it focuses conservation efforts on a species currently listed as endangered. The purpose and objectives of this study are required to gain a better understanding of the ecology, conservation needs, and magnitude of anthropogenic impacts on the Smooth Softshell. The planned approach and procedures are consistent with the accepted principles of the conservation, management, research, and education.

TIME TABLE

Step	Process/Action	Time Line
1	Conduct site reconnaissance using trapping efforts	April – May 2013
2	Initiate 1st year active season trapping surveys	April – September 2013
3	Initiate 1st year active season radio-telemetric monitoring	May 2013 – September 2013
4	Initiate 1st year nesting surveys	May 2013 – July 2013
5	Initiate 1st year over-wintering radio-telemetric monitoring	November 2013 – February 2014
6	Submit first year summary report	March 2014
7	Initiate 2nd year active season trapping surveys	April – September 2014
8	Initiate 2nd year active season radio-telemetric monitoring	May 2013 – September 2014

9	Initiate 2nd year nesting surveys	May 2014 – July 2014
10	Initiate 2nd year over-wintering radio-telemetric monitoring	November 2014 – February 2015
11	End field activities	March 2015
12	Submit final report	April 2015

BUDGET NARRATIVE

EXPENSE LINE ITEM	YEAR 1 REQUEST	YEAR 1 MATCH	YEAR 1 TOTAL	YEAR 2 REQUEST	YEAR 2 MATCH	YEAR 2 TOTAL	PROJECT TOTAL REQUEST	PROJECT TOTAL MATCH	PROJECT TOTAL TOTAL
SALARIES AND WAGES									
Professional	---------	$5,198	$5,198	---------	$5,196	$5,196	---------	$10,394	$10,394
Grad Res Asst ac yr	$16,125	---------	$16,125	$16,125	---------	$16,125	$32,251	---------	$32,251
GRA - summer (no classes)	$5,375	---------	$5,375	$5,375	---------	$5,375	$10,750	---------	$10,750
Non-student hourly or Off-campus	$8,000	---------	$8,000	$8,000	---------	$8,000	$16,000	---------	$16,000
TOTAL SALARIES AND WAGES	**$29,500**	**$5,198**	**$34,698**	**$29,500**	**$5,196**	**$34,696**	**$59,001**	**$10,394**	**$69,395**
FRINGE BENEFITS									
Professional @ 44.67%	---------	$2,322	$2,322	---------	$2,321	$2,321	---------	$4,643	$4,643
Grad Res Asst ac yr @ 5.99%	$966	---------	$966	$966	---------	$966	$1,932	---------	$1,932
GRA - summer (no classes) 13.64%	$733	---------	$733	$733	---------	$733	$1,466	---------	$1,466
Non-student hourly or Off-campus @ 7.79%	$623	---------	$623	$623	---------	$623	$1,246	---------	$1,246
TOTAL FRINGE BENEFITS	**$2,322**	**$2,322**	**$4,644**	**$2,322**	**$2,321**	**$4,643**	**$4,645**	**$4,643**	**$9,288**
TOTAL SALARIES, WAGES, AND FRINGE BENEFITS	**$31,823**	**$7,520**	**$39,343**	**$31,823**	**$7,517**	**$39,340**	**$63,645**	**$15,037**	**$78,682**
TRAVEL									
Out of state	---------	---------	---------	---------	---------	---------	---------	---------	---------
In state	$7,021	---------	$7,021	$7,000	---------	$7,000	$14,021	---------	$14,021
Foreign	---------	---------	---------	---------	---------	---------	---------	---------	---------
TOTAL TRAVEL	**$7,021**	---------	**$7,021**	**$7,000**	---------	**$7,000**	**$14,021**	---------	**$14,021**
MATERIALS & SUPPLIES									
Field Supplies	$5,500	---------	$5,500	$5,500	---------	$5,500	$11,000	---------	$11,000
TOTAL MATERIALS & SUPPLIES	**$5,500**	---------	**$5,500**	**$5,500**	---------	**$5,500**	**$11,000**	---------	**$11,000**
CONTRACTUAL SERVICES									
Radiography	$1,500	---------	$1,500	$1,500	---------	$1,500	$3,000	---------	$3,000
TOTAL CONTRACTUAL SERVICES	**$1,500**	---------	**$1,500**	**$1,500**	---------	**$1,500**	**$3,000**	---------	**$3,000**
TOTAL DIRECT COSTS	**$45,844**	**$7,520**	**$53,364**	**$45,823**	**$7,517**	**$53,340**	**$91,666**	**$15,037**	**$106,703**
MODIFIED TOTAL DIRECT COSTS (MTDC)	**$45,844**	**$7,520**	**$53,364**	**$45,823**	**$7,517**	**$53,340**	**$91,666**	**$15,037**	**$106,703**
F&A (20% DIRECT COSTS)	**$9,169**	---------	**$9,169**	**$9,165**	---------	**$9,165**	**$18,333**	---------	**$18,333**
F&A (58.6% TOTAL DIRECT COSTS)	---------	**$4,407**	**$4407**	---------	**$4,405**	**$4,405**	---------	**$8,812**	**$8,812**
UNRECOVERED F&A (20% VS. 58.6%)	---------	**$17,696**	**$17,696**	---------	**$17,688**	**$17,688**	---------	**$35,383**	**$35,383**
TOTAL PROPOSED PROJECT BUDGET	**$55,012**	**$29,622**	**$84,635**	**$54,987**	**$29,610**	**$84,597**	**$110,000**	**$59,232**	**$169,231**
PERCENTAGE MATCHED	**65%**	**35%**		**65%**	**35%**				

BUDGET JUSTIFICATION

SALARY, WAGES, FRINGE BENEFITS

Funds are requested for a full-time graduate student for two full years and an hourly field assistant when fieldwork is conducted. Salaried staff fringe benefits are assessed at 44.67%; hourly support fringe rate is assessed at 7.79%; graduate student fringe rate is assessed during the fall academic year at 5.99%, and graduate student fringe rate for the summer at 13.64%. These are in accordance with the University fringe benefit mandates. Dr. Michael Dreslik, PI, will function as the field and administrative organizer and conduct the field work as needed, supervising field-workers, manage the data collected, and generate all reports. A portion of Dr. Dreslik's salary will be used as cost-share for this project.

MATERIALS AND SUPPLIES

This project will require items such as radio-transmitters, temperature data loggers, weatherproof paper, batteries, printer cartridges, miscellaneous office supplies and general laboratory supplies such as cry-tubes, syringes, needles, storage boxes, and any other supplies necessary to conduct the project.

TRAVEL

Travel will include mileage to and from the field sites and accommodations for up to three people. Travel expenses for this project include overnight accommodations; per diem at rates established by the UIUC; mileage expenses while using state, leased, or personal vehicles. Mileage includes travel to and from the field sites. Overnight accommodations and per diem are for up to three people (P.I., graduate students, and hourly field technician. Travel may also be used to present the results of this study at local and national scientific conferences.

CONTRACTUAL SERVICES

Contractual costs include, radiography, computer software, printing and duplicating costs associated with report writing and publication of results in the peer-reviewed literature (page charges, reprints), and registration to national meetings and conferences to report the results of the research are included here.

FACILITIES AND ADMINISTRATION (F & A)

20% is assessed to the sponsor's federal direct costs request. 58.6% is assessed to UI's direct costs cost share. Un-recovered F&A is claimed as the cost share for the difference from the lower, negotiated F&A rate (20%) and the full-rate (58.6 %).

COMPLIANCE

The IDNR will use its CERP (Comprehensive Environment Review Process) as a tool to aid the Department in meeting NEPA compliance for the project outlined under this grant proposal.

It is the Department's policy to require CERP applications for all land distributing activities unless those activities are covered by CERP exemptions.

All planned activities will also be in compliance with the Endangered Species Act. All determinations and documentation will be in accordance with the current established U.S. Fish and Wildlife Service protocols for section 7.

All planned activities will be in compliance with the National Historic Preservation Act and the Council on Historic Preservation Act. All determinations and documentation will be in accordance with the terms of the Programmatic Agreement, as amended, effective September 23, 2002.

When applicable, those planned activities which involve a floodplain and/or jurisdiction wetlands will be done in accordance with the Presidential Executive Orders 11988 and 11990.

When applicable, those planned activities which involve programs and/or site improvements will be done in accordance with Section 504 of the rehabilitation Act and the Americans with Disabilities Act.

When applicable, those planned activities which involve the use of pesticides, herbicides or other comparable chemicals will be done in accordance with the current state and federal regulations to assure the safe and legal application of those chemicals. All chemicals will be applied in accordance with the manufacturers label instructions. All person applying chemicals will be licensed by the Illinois Department of Agriculture as a chemical operator along with a licensed applicator, in accordance with Illinois state law.

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